

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES**

In re patent application of:

Jason M. Benz

Atty. Docket No.: BUR920030121US1

Serial No.: 10/707,908

Group Art Unit: 1756

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Examiner: Ruggles, John S.

For: PROCESS FOR CREATING PHASE EDGE STRUCTURES

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANTS' APPEAL BRIEF

Sirs:

Appellant respectfully appeals the final rejection of claims 1, 3-5, 8, 10-12, 15, 17-18, and 21-26, in the Office Action dated April 20, 2007. A Notice of Appeal and Pre-Appeal Brief Request for Review was timely filed on July 20, 2007. A decision on the Pre-Appeal Brief Request was mailed on August 22, 2007 setting a one-month response period. Therefore, this Appeal Brief is timely filed.

Appeal Brief

I. REAL PARTY IN INTEREST

The real party in interest is International Business Machines Corporation, Armonk, New York, assignee of 100% interest of the above-referenced patent application.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1, 3-5, 8, 10-12, 15, 17-18, and 21-26, all the claims pending in the application. Claims 1, 3-5, 15, 17-18, 24, and 26 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Dao, et al. (U.S. Patent No. 5,302,477), hereinafter referred to as Dao, in view of Schroeder, et al. (U.S. Publication No. 2003/0027057), hereinafter referred to as Schroeder, and in further view of either Levenson (U.S. Patent No. 6,251,549), Rolfson (U.S. Patent No. 6,395,432), or Applicant's Admitted Prior Art. Claims 8, 10-12, and 25 stand rejected under 35 U.S.C. §103(a) as unpatentable over Dao, in view of Schroeder, and in further view of Tzu, et al. (U.S. Patent No. 5,888,678), hereinafter referred to as Tzu. Claims 8, 10-12, and 25 stand rejected under 35 U.S.C. §103(a) as unpatentable over either Dao, in view of Schroeder, and in further view of Tzu and in further view of either Levenson, Rolfson, or AAPA. Claims 21 and 23 stand

Appeal Brief

rejected under 35 U.S.C. §103(a) as unpatentable over either Dao, in view of Schroeder, in further view of either Levenson, Rolfson, or AAPA, in further view of Sandstrom (U.S. Publication No. 2002/0125443). Claim 22 stands rejected under 35 U.S.C. §103(a) as unpatentable over either Dao or Schroeder, in view of Tzu and in further view of either Levenson, Rolfson, or AAPA, and in further view of Sandstrom.

Claims 1, 3-6, 15, and 17-19 stand rejected under 35 U.S.C. §102(b) as being anticipated by Dao, et al. (U.S. Patent No. 5,302,477), hereinafter referred to as Dao. Claims 1, 3-6, 15, and 17-19 stand rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Schroeder, et al. (U.S. Publication No. 2003/0027057), hereinafter referred to as Schroeder. Claims 1, 3-6, 15, and 17-19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over either Dao or Schroeder, in view of either Levenson (U.S. Patent No. 6,251,549), Rolfson (U.S. Patent No. 6,395,432), or Applicant's Admitted Prior Art. Claims 8 and 10-13 stand rejected under 35 U.S.C. §103(a) as unpatentable over either Dao or Schroeder, in view of Tzu, et al. (U.S. Patent No. 5,888,678), hereinafter referred to as Tzu. Claims 8 and 10-13 stand rejected under 35 U.S.C. §103(a) as unpatentable over either Dao or Schroeder, in view of Tzu and in further view of either Levenson, Rolfson, or AAPA. Claims 21 and 23 stand rejected under 35 U.S.C. §103(a) as unpatentable over either Dao or Schroeder, in view of either Levenson, Rolfson, or AAPA, in further view of Sandstrom (U.S. Publication No. 2002/0125443). Claim 22 stands rejected under 35 U.S.C. §103(a) as unpatentable over either Dao or Schroeder, in view of Tzu and in further view of either Levenson, Rolfson, or AAPA, and in further view of Sandstrom.

IV. STATUS OF AMENDMENTS

In response to the Office Action mailed on April 20, 2007 (hereinafter referred to as the "Office Action"), Appellants filed an after-final Response on June 27, 2007. An Advisory Action dated May 31, 2007 indicated that, upon filing an appeal, the Amendment filed on May 17, 2007 would be entered, but would not place the application in condition for allowance, and that the rejections of the claims would remain. The claims shown in the appendix are shown in their amended form as of the June 27, 2007 Amendment.

V. SUMMARY OF CLAIMED SUBJECT MATTER

One feature of the invention is a method of forming a phase shift mask. Claim 1 defines this feature as follows: "a method of forming a phase shift mask." This feature is described at various points in the specification, for example paragraph [0018] describes this feature as follows: "Figures 1A-3B illustrate a methodology that is utilized to create a phase shift mask. This methodology is not necessarily well known; however, the invention is an improvement on this methodology." This is shown in Figures 1A-3B.

Another feature of the invention is forming an opaque layer on a transparent substrate. Claim 1 defines this feature as follows: "forming an opaque layer on a transparent substrate." This feature is described at various points in the specification, for example paragraph [0020] describes this feature as follows: "Figures 4A-6A are top views and Figures 4B-6B are cross-sectional views drawn along line X-X'. As shown in

Appeal Brief

Figures 4A and 4B, the invention performs a first patterning of the opaque layer 112 to expose a first region 114 of the transparent substrate 110." This is shown in Figure 4A-6A.

Another feature of the invention is performing a first patterning of the opaque layer to expose a first region of the transparent substrate. Claim 1 defines this feature as follows: "performing a first patterning of said opaque layer to expose a first region of said transparent substrate." This feature is described at various points in the specification, for example paragraph [0020] describes this feature as follows: "As shown in Figures 4A and 4B, the invention performs a first patterning of the opaque layer 112 to expose a first region 114 of the transparent substrate 110. The invention then etches the first region 114 of the transparent substrate 110 through the opaque layer 112 to create a phase shift region within the transparent substrate 110, as shown in Figures 4A and 4B." This is shown in Figures 4A and 4B.

Another feature of the invention is that the first region comprises an uninterrupted rectangular surface. Claim 1 defines this feature as follows: "wherein said first region comprises an uninterrupted rectangular surface." This feature is described at various points in the specification, for example paragraph [0021] describes this feature as follows: "the first region 114 comprises a rectangle and the second region 116 comprises a similarly shaped and sized rectangle as the first region; however, one ordinarily skilled in the art would understand that these openings can have any shape and can be different shapes." This is shown in Figures 4A-4B.

Appeal Brief

Another feature of the invention is etching the first region of the transparent substrate to create a phase shift region within the transparent substrate. Claim 1 defines this feature as follows: "etching said first region of said transparent substrate to create a phase shift region within said transparent substrate." This feature is described at various points in the specification, for example paragraph [0023] describes this feature as follows: "the invention etches the first region of the transparent quartz substrate through the chrome layer to create a phase shift region within the transparent quartz substrate." This is shown in Figure 8.

Another feature of the invention is performing additional patterning of the opaque layer to expose a second region of the transparent substrate, such that the second region comprises a similar shape and size as the first region. Claim 1 defines this feature as follows: "performing additional patterning of said opaque layer to expose a second region of said transparent substrate, such that said second region comprises a similar shape and size as said first region." This feature is described at various points in the specification, for example paragraph [0021] describes this feature as follows: "the first region 114 comprises a rectangle and the second region 116 comprises a similarly shaped and sized rectangle as the first region; however, one ordinarily skilled in the art would understand that these openings can have any shape and can be different shapes." This is shown in Figure 4A-4B.

Another feature of the invention is that the second region is adjacent the first region. Claim 1 defines this feature as follows: "wherein said second region is adjacent said first region." This feature is described at various points in the specification, for

Appeal Brief

example paragraph [0023] describes this feature as follows: "Next, the invention performs additional patterning of the opaque chrome layer to expose a second region of the transparent quartz substrate that is adjacent the first region 804." This is shown in Figure 8.

Another feature of the invention is that the additional patterning process enlarges an opening formed in the first patterning process. Claim 1 defines this feature as follows: "wherein said additional patterning process enlarges an opening formed in said first patterning process." This feature is described at various points in the specification, for example paragraph [0023] describes this feature as follows: "This additional patterning process enlarges the opening formed in the first patterning process. The processing here is beneficial for a number of different reasons." This is shown in Figure 8.

Another feature of the invention is a method of forming a phase shift mask. Claim 8 defines this feature as follows: "a method of forming a phase shift mask." This feature is described at various points in the specification, for example paragraph [0018] describes this feature as follows: "Figures 1A-3B illustrate a methodology that is utilized to create a phase shift mask. This methodology is not necessarily well known; however, the invention is an improvement on this methodology." This is shown in Figures 1A-3B.

Another feature of the invention is forming an opaque layer on a transparent substrate. Claim 8 defines this feature as follows: "forming an opaque layer on a transparent substrate." This feature is described at various points in the specification, for example paragraph [0020] describes this feature as follows: "Figures 4A-6A are top views and Figures 4B-6B are cross-sectional views drawn along line X-X'. As shown in

Appeal Brief

Figures 4A and 4B, the invention performs a first patterning of the opaque layer 112 to expose a first region 114 of the transparent substrate 110." This is shown in Figure 4A-6A.

Another feature of the invention is performing a first patterning of the opaque layer to expose a first region of the transparent substrate. Claim 8 defines this feature as follows: "performing a first patterning of said opaque layer to expose a first region of said transparent substrate." This feature is described at various points in the specification, for example paragraph [0020] describes this feature as follows: "As shown in Figures 4A and 4B, the invention performs a first patterning of the opaque layer 112 to expose a first region 114 of the transparent substrate 110. The invention then etches the first region 114 of the transparent substrate 110 through the opaque layer 112 to create a phase shift region within the transparent substrate 110, as shown in Figures 4A and 4B." This is shown in Figures 4A and 4B.

Another feature of the invention is that the first region comprises an uninterrupted rectangular surface. Claim 8 defines this feature as follows: "wherein said first region comprises an uninterrupted rectangular surface." This feature is described at various points in the specification, for example paragraph [0021] describes this feature as follows: "the first region 114 comprises a rectangle and the second region 116 comprises a similarly shaped and sized rectangle as the first region; however, one ordinarily skilled in the art would understand that these openings can have any shape and can be different shapes." This is shown in Figures 4A-4B.

Appeal Brief

Another feature of the invention is etching the first region of the transparent substrate to create a phase shift region within the transparent substrate. Claim 8 defines this feature as follows: "etching said first region of said transparent substrate to create a phase shift region within said transparent substrate." This feature is described at various points in the specification, for example paragraph [0023] describes this feature as follows: "the invention etches the first region of the transparent quartz substrate through the chrome layer to create a phase shift region within the transparent quartz substrate." This is shown in Figure 8.

Another feature of the invention is performing additional patterning of the opaque layer to expose second regions and third regions of the transparent substrate, such that the second regions comprise similar shapes and sizes as the first regions. Claim 8 defines this feature as follows: "performing additional patterning of said opaque layer to expose second regions and third regions of said transparent substrate, such that said second regions comprise similar shapes and sizes as said first regions." This feature is described at various points in the specification, for example paragraph [0020] describes this feature as follows: "As shown in Figures 4A and 4B, the invention performs a first patterning of the opaque layer 112 to expose a first region 114 of the transparent substrate 110. The invention then etches the first region 114 of the transparent substrate 110 through the opaque layer 112 to create a phase shift region within the transparent substrate 110, as shown in Figures 4A and 4B." This is shown in Figures 4A and 4B.

Another feature of the invention is that the second regions are adjacent the first regions and the third regions are separated from the first regions. Claim 8 defines this

Appeal Brief

feature as follows: "wherein said second regions are adjacent said first regions and said third regions are separated from said first regions." This feature is described at various points in the specification, for example paragraph [0023] describes this feature as follows: "Next, the invention performs additional patterning of the opaque chrome layer to expose a second region of the transparent quartz substrate that is adjacent the first region 804." This is shown in Figure 8.

Another feature of the invention is such that the third regions are devoid of phase shift features, and wherein the additional patterning process enlarges openings formed in the first patterning process. Claim 8 defines this feature as follows: "such that said third regions are devoid of phase shift features, and wherein said additional patterning process enlarges openings formed in said first patterning process." This feature is described at various points in the specification, for example paragraph [0023] describes this feature as follows: "the invention performs additional patterning of the opaque chrome layer to expose a second region of the transparent quartz substrate that is adjacent the first region 804. This additional patterning process enlarges the opening formed in the first patterning process." This is shown in Figure 8.

Another feature of the invention is a method of forming a phase shift mask. Claim 15 defines this feature as follows: "a method of forming a phase shift mask." This feature is described at various points in the specification, for example paragraph [0018] describes this feature as follows: "Figures 1A-3B illustrate a methodology that is utilized to create a phase shift mask. This methodology is not necessarily well known; however, the invention is an improvement on this methodology." This is shown in Figures 1A-3B.

Appeal Brief

Another feature of the invention is forming an opaque chrome layer on a transparent quartz substrate. Claim 15 defines this feature as follows: "forming an opaque chrome layer on a transparent quartz substrate." This feature is described at various points in the specification, for example paragraph [0020] describes this feature as follows: "Figures 4A-6A are top views and Figures 4B-6B are cross-sectional views drawn along line X-X'. As shown in Figures 4A and 4B, the invention performs a first patterning of the opaque layer 112 to expose a first region 114 of the transparent substrate 110." This is shown in Figure 4A-6A.

Another feature of the invention is performing a first patterning of the opaque chrome layer to expose a first region of the transparent quartz substrate, wherein the first region comprises an uninterrupted rectangular surface. Claim 15 defines this feature as follows: "performing a first patterning of said opaque chrome layer to expose a first region of said transparent quartz substrate, wherein said first region comprises an uninterrupted rectangular surface." This feature is described at various points in the specification, for example paragraph [0023] describes this feature as follows: "in item 800, the invention performs a first patterning of the opaque chrome layer to expose a first region of the transparent quartz substrate." This is shown in Figure 8.

Another feature of the invention is etching the first region of the transparent quartz substrate to create a phase shift region within the transparent quartz substrate. Claim 15 defines this feature as follows: "etching said first region of said transparent quartz substrate to create a phase shift region within said transparent quartz substrate." This feature is described at various points in the specification, for example paragraph

Appeal Brief

[0023] describes this feature as follows: "the invention etches the first region of the transparent quartz substrate through the chrome layer to create a phase shift region within the transparent quartz substrate." This is shown in Figure 8.

Another feature of the invention is performing additional patterning of the opaque chrome layer to expose a second region of the transparent quartz substrate, such that the second region comprises a similar shape and size as the first region. Claim 15 defines this feature as follows: "performing additional patterning of said opaque chrome layer to expose a second region of said transparent quartz substrate, such that said second region comprises a similar shape and size as said first region." This feature is described at various points in the specification, for example paragraph [0020] describes this feature as follows: "As shown in Figures 4A and 4B, the invention performs a first patterning of the opaque layer 112 to expose a first region 114 of the transparent substrate 110. The invention then etches the first region 114 of the transparent substrate 110 through the opaque layer 112 to create a phase shift region within the transparent substrate 110, as shown in Figures 4A and 4B." This is shown in Figures 4A and 4B.

Another feature of the invention is that the second region is adjacent the first region, and wherein the additional patterning process enlarges an opening formed in the first patterning process. Claim 15 defines this feature as follows: "wherein said second region is adjacent said first region, and wherein said additional patterning process enlarges an opening formed in said first patterning process." This feature is described at various points in the specification, for example paragraph [0023] describes this feature as follows: "Next, the invention performs additional patterning of the opaque chrome layer

Appeal Brief

to expose a second region of the transparent quartz substrate that is adjacent the first region 804." This is shown in Figure 8.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented for review is whether claims 1, 3-5, 8, 10-12, 15, 17-18, and 21-26 are unpatentable over and/or anticipated by Dao, Schroeder, Levenson, Rolfson, AAPA, Tzu, Sandstrom.

VII. ARGUMENT

A. The Rejection Based on Dao and Schroeder

1. The Position in the Office Action

The Office Action states:

Claims 1, 3-5, 15, 17-18, 24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dao et al. (US 5,302,477), especially in view of Schroeder et al. (US 2003/0027057).

Dao et al. teach an inverted phase-shifted reticle or mask (PSM) having adjacent inverted phase features with PS rims .or phase edges between 00 and 180° phase features; and methods of fabricating the PSM (title, abstract). The methods of fabricating the PSM include performing first patterning or etching of an opaque chrome (Cr) mask layer 21 (instant claims 4 and 18) formed on a transparent quartz substrate 20 (as shown in Figure 7, instant claim 5) to expose a first region of the transparent substrate 20, which is etched to form a PS region 53 first opening (Figure 8, which also corresponds to 24 in Figures

Appeal Brief

10 and 4A). This is followed by performing additional second patterning or etching of the opaque Cr layer to expose an adjacent second region 27 of the transparent substrate to enlarge the first opening formed in the first region 24 over a continuous area of the transparent quartz substrate (as shown in Figure 4A, which clearly depicts Figure 10 without any Cr at all between the first region 24 and the adjacent second region 27, col. 8 line 46 to col. 9 line 13, instant claims 3 and 17). In the PSM shown by Figure 4A, a first (etched PS) rectangular region 24 is directly adjacent to a second (unetched non-PS) rectangular region 27, in which both the first rectangular region 24 and the second rectangular region 27 are similarly shaped and sized (col. 5 line 67 to col. 8 line 3). These methods of making a PSM are not limited to making a rim PSM, but these methods are also specifically contemplated to be applicable for making any other PSM pattern having a PS element or region in close proximity to another (e.g., non-PS, etc.) region, as exemplified by the PSM having a (rectangular) PS region 42b and a directly adjacent (rectangular) non-PS region 45a, which are shown in Figure 6 as having similar shapes and sizes (col. 8 lines 1-11).

Dao et al. does not expressly require that the first rectangular region has an uninterrupted rectangular surface lacking an intervening structure.

Schroeder et al. teach a phase shift mask 400 (PSM) and method of manufacturing the PSM (abstract). Figure 6A shows a PSM 400 having a transparent quartz substrate 402 (instant claim 5) with a first etched region 458 or 454 for a 180° phase (shift, PS) feature and an adjacent second unetched region 460 or 456 for a 0° phase (non-PS) feature next to an overlying patterned opaque chrome (Cr) layer 404 (paragraphs [0041]-

Appeal Brief

[0047]). In the method of manufacturing the PSM, the opaque layer is preferably formed on the transparent substrate and patterned before etching of the underlying transparent substrate. Alternatively, the opaque layer can be patterned after etching the transparent substrate [0043]. The method for making the PSM in Figure 6A would reasonably be expected (especially in view of the Dao et al. method discussed above) to involve first patterning of an opening in the opaque layer, etching of the underlying transparent substrate at a first region 458 or 454 through the opening in the opaque Cr mask layer (instant claims 4 and 18), and additional patterning of the opaque layer to enlarge the opening that forms a second adjacent (non-PS) region 460 or 456 so that both PS and non-PS regions are formed over a continuous area of the transparent quartz substrate (instant claims 3 and 17). Figure 6B illustrates a top view of the PSM in Figure 6A that shows parallel lines for phase edge 452 between PS 458 and non-PS 460, as well as the adjacent edge of the patterned opaque Cr layer 404. These lines can extend only partially across the length of the mask 400 [0048], which is consistent with a rectangular first region 458 having an uninterrupted surface and an adjacent rectangular second region 460 having a similar shape. Even though the apparent width of non_PS region 460 in Figures 6A and 6B appears to be narrower than the adjacent PS region 458, non-PS region 456 on the other side of adjacent PS region 458 appears to have the same or similar width or size as the adjacent PS region. 458. Also, PS region 454 appears to have the same or similar width or size as non-PS region 460.

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making a PSM including first patterning of a first rectangular

Appeal Brief

opening or region in an opaque layer and etching of an underlying transparent substrate, then additional patterning of the opaque layer for expanding the first rectangular opening or region, forming a similarly sized and shaped second rectangular opening or region in the opaque layer (as taught by Dao et al.), to make the first rectangular region or opening as an uninterrupted rectangular surface that lacks an intervening structure, because this is a simple alternative PSM configuration that is reasonably encompassed within “any” PSM pattern having a PS element or region in close proximity to another (e.g., non-PS, etc.) region (as contemplated by Dao et al.). This would have been especially obvious in view of the known PSM configuration including an uninterrupted rectangular surface first region lacking an intervening structure and an adjacent rectangular second region having a similar shape (as taught by Schroeder et al.), because one of ordinary skill in the art would have a reasonable expectation of success in making this known PSM configuration (as taught by Schroeder et al.) by the method of making a PSM including first patterning of a first rectangular opening or region in an opaque layer and etching of an underlying transparent substrate, then additional patterning of the opaque layer for expanding the first rectangular opening or region, forming a similarly sized and shaped second rectangular opening or region in the opaque layer (as taught by Dao et al., reading on instant claims 1, 15, 24, and 26).

2. Appellants' Position

a. Independent Claims 1 and 15

Appellants traverse the rejections because, among other reasons, it would not have been obvious to combine Dao with Schroeder. Appellants submit that, because Dao teaches regions comprising a rectangular ring having an intervening structure in the middle thereof, Dao teaches away from the claimed features “wherein said first region comprises an uninterrupted rectangular surface ... and ... said second region comprises a similar shape and size as said first region” (independent claims 1 and 15). As illustrated in Figures 6A and 6B of Appellants’ disclosure, a first region 114 and the second region 116 each comprise an uninterrupted rectangular surface that lacks an intervening structure. To the contrary, as illustrated in Figures 4A and 10 of Dao, the region 24 comprises a rectangular ring with an intervening structure (i.e., the block 23) in the middle thereof. Similarly, the region 27 comprises a rectangular ring with an intervening structure (i.e., the opening 26) in the middle thereof. When a reference teaches away from an invention, this tends to show that one ordinarily skilled in the art would not have made reference to the reference. Therefore, Dao would not be referred to illustrate the claimed features “wherein said first region comprises an uninterrupted rectangular surface” (independent claims 1 and 15).

More specifically, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the Office Action asserts teaches the second region of the claimed invention) is centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that

Appeal Brief

the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).

FIG 9

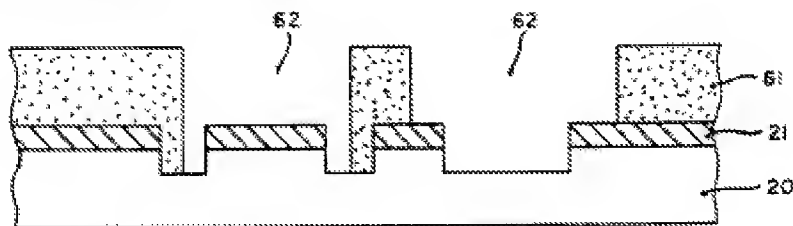
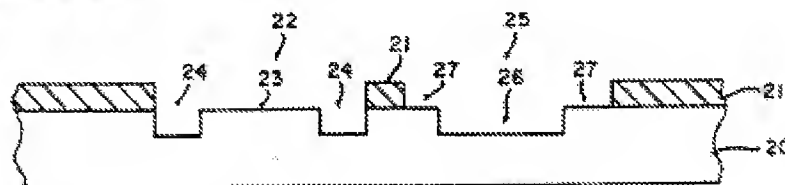


FIG 10



Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted rectangular structure. Thus, Appellants submit that the Office Action’s assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Accordingly, because the patterning layer “must be” aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely,

Appeal Brief

independent claims 1 and 15 define that “said first region comprises an uninterrupted rectangular surface”. To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the “[p]atterning layer 61 must be precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26” (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants’ position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features “wherein said first region comprises an uninterrupted rectangular surface ... and ... said second region comprises a similar shape and size as said first region” as defined in independent claims 1 and 15.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention. Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the “first region” of the claimed invention) is not adjacent the region 27 (which the Office Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second region is adjacent said first region” as defined in independent claims 1 and 15.

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have similar size and shape as the region 458 (which the Office Action asserts teaches the

Appeal Brief

“first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second region comprises a similar shape and size as said first region” as defined in independent claims 1 and 15.

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

b. Dependent Claims 3 and 17

It is Appellants' position that the proposed combination of Dao and Schroder does not render obvious independent claims 1 and 15 and similarly does not render obvious dependent claims 3 and 17. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

c. Dependent Claims 4 and 18

It is Appellants' position that the proposed combination of Dao and Schroder does not render obvious independent claims 1 and 15 and similarly does not render obvious dependent claims 4 and 18. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

d. Dependent Claim 5

It is Appellants' position that the proposed combination of Dao and Schroder does not render obvious independent claim 1 and similarly does not render obvious dependent

Appeal Brief

claim 5. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

e. Dependent Claims 24 and 26

Appellants traverse the rejections because, among other reasons, it would not have been obvious to combine Dao with Schroeder. Appellants submit that, because Dao teaches regions comprising a rectangular ring having an intervening structure in the middle thereof, Dao teaches away from the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claims 24 and 26). As illustrated in Figures 6A and 6B of Appellants’ disclosure, a first region 114 and the second region 116 each comprise an uninterrupted rectangular surface that lacks an intervening structure. To the contrary, as illustrated in Figures 4A and 10 of Dao, the region 24 comprises a rectangular ring with an intervening structure (i.e., the block 23) in the middle thereof. Similarly, the region 27 comprises a rectangular ring with an intervening structure (i.e., the opening 26) in the middle thereof. When a reference teaches away from an invention, this tends to show that one ordinarily skilled in the art would not have made reference to the reference. Therefore, Dao would not be referred to illustrate the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claims 24 and 26).

More specifically, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the Office Action asserts teaches the second region of the claimed invention) is

Appeal Brief

centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).

FIG 9

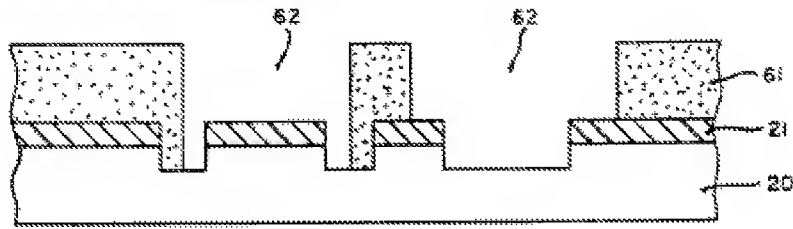
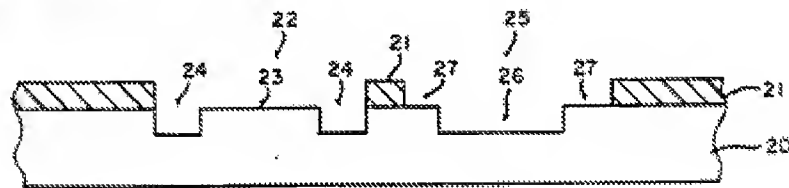


FIG 10



Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted rectangular structure. Thus, Appellants submit that the Office Action’s assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Accordingly, because the patterning layer “must be” aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from

Appeal Brief

the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely, independent claims 24 and 26 define that “said uninterrupted rectangular surface lacks an intervening structure”. To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the “[p]atterning layer 61 **must be** precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26” (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants’ position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” as defined in dependent claims 24 and 26.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention. Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the “first region” of the claimed invention) is not adjacent the region 27 (which the Office Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second region is adjacent said first region” as defined in independent claims 1 and 15 (from which dependent claims 24 and 26, respectively, depend upon).

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have

Appeal Brief

similar size and shape as the region 458 (which the Office Action asserts teaches the “first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second region comprises a similar shape and size as said first region” as defined in independent claims 1 and 15 (from which dependent claims 24 and 26, respectively, depend upon).

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

B. The Rejection Based on Dao, Schroeder, and Levenson, Rolfson, or Appellant’s admitted prior art (AAPA)

1. The Position in the Office Action

The Office Action states:

Claims 1, 3-5, 15, 17-18, 24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dao et al. (US 5,302,477), especially in view of Schroeder et al. (US 2003/0027057), and further in view of either Levenson (US 6,251,549), Rolfson (US 6,395,432), or Appellant’s admitted prior art (AAPA).

While teaching other aspects of the instant claims, neither Dao et al. nor Schroeder et al. specifically teach a method of forming a PSM having adjacent first and second similarly shaped and sized rectangular 00 non-PS and 180° PS features or regions in the particular configuration shown by instant Figure 5A or instant Figure 6A (as specific examples of instant claims 1, 3-5, 15, 17-18, 24, and 26).

Appeal Brief

However, the particular configuration shown by instant Figure 5A or instant Figure 6A (for a PSM having book-matched adjacent first and second similarly shaped and sized rectangular 0° non-PS and 180° PS features or regions, wherein the first rectangular region has an uninterrupted rectangular surface that lacks an intervening structure) is either the same or very similar to the PSM configurations exemplified by either Levenson (Figures 9-11, col. 6 lines 53-61), Rolfson (Figure 12, col. 6 lines 28-36), or even AAPA (as shown in instant prior art Figures 1A to 3B, which Appellant admits at [0020] lines 1-5 to have the same PSM structure or configuration as shown by instant Figures 4A to 6B). So, it would have been obvious to one of ordinary skill in the art at the time of the invention in the methods of forming PSMs having adjacent first and second PS regions (as taught by Dao et al., especially in view of Schroeder et al.) to form these adjacent first and second PS regions in a book-matched configuration of similarly shaped and sized rectangular 0° non-PS and 180° PS features or regions, wherein the first rectangular region has an uninterrupted rectangular surface that lacks an intervening structure (as taught by either Levenson, Rolfson, or AAPA as exemplified by instant prior art Figures 1A to 3B), which has the same PSM structure exemplified by instant Figures 5A or 6A, in order to achieve a corresponding desired imaged pattern through such a PSM (instant claims 1, 3-5, 15, 17-18, 24, and 26).

2. Appellants' Position

a. Independent Claims 1 and 15

Appellants traverse the rejections because, among other reasons, it would not have been obvious to combine Dao with Schroeder. Appellants submit that, because Dao teaches regions comprising a rectangular ring having an intervening structure in the middle thereof, Dao teaches away from the claimed features “wherein said first region comprises an uninterrupted rectangular surface ... and ... said second region comprises a similar shape and size as said first region” (independent claims 1 and 15). As illustrated in Figures 6A and 6B of Appellants’ disclosure, a first region 114 and the second region 116 each comprise an uninterrupted rectangular surface that lacks an intervening structure. To the contrary, as illustrated in Figures 4A and 10 of Dao, the region 24 comprises a rectangular ring with an intervening structure (i.e., the block 23) in the middle thereof. Similarly, the region 27 comprises a rectangular ring with an intervening structure (i.e., the opening 26) in the middle thereof. When a reference teaches away from an invention, this tends to show that one ordinarily skilled in the art would not have made reference to the reference. Therefore, Dao would not be referred to illustrate the claimed features “wherein said first region comprises an uninterrupted rectangular surface” (independent claims 1 and 15).

More specifically, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the Office Action asserts teaches the second region of the claimed invention) is centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that

Appeal Brief

the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).

FIG. 9

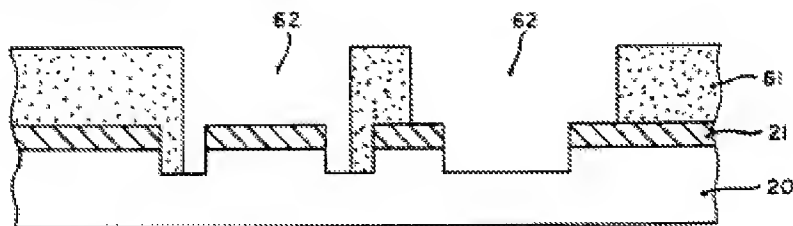
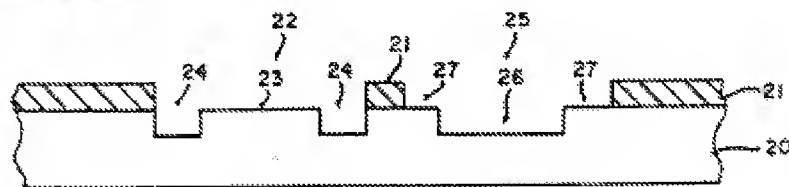


FIG. 10



Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted rectangular structure. Thus, Appellants submit that the Office Action’s assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Accordingly, because the patterning layer “must be” aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely,

Appeal Brief

independent claims 1 and 15 define that “said first region comprises an uninterrupted rectangular surface”. To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the “[p]atterning layer 61 must be precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26” (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants’ position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features “wherein said first region comprises an uninterrupted rectangular surface ... and ... said second region comprises a similar shape and size as said first region” as defined in independent claims 1 and 15.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention. Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the “first region” of the claimed invention) is not adjacent the region 27 (which the Office Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second region is adjacent said first region” as defined in independent claims 1 and 15.

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have similar size and shape as the region 458 (which the Office Action asserts teaches the

Appeal Brief

“first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second region comprises a similar shape and size as said first region” as defined in independent claims 1 and 15.

In addition, Appellants submit that Levenson is introduced by the Office Action for the sole purpose of illustrating first and second similarly shaped and sized regions that are adjacent one another. More specifically, the Office Action asserts that “neither Dao et al. or Schroeder et al. specifically teach a method of forming a PSM having adjacent first and second similarly shaped and sized rectangular 0° and 180° phase features ... However ... a PSM having book-matched adjacent first and second similarly shaped and sized rectangular regions is well known in the art of making PSMs, as exemplified by ... Levenson (Figures 9-11, col. 6 lines 53-61)” (Office Action, p. 7, para. 4 – p. 8, para. 1).

Appellants traverse the rejections because it would not have been obvious to combine Levenson with Dao or Schroeder. More specifically, Appellants submit that because Levenson teaches *simultaneously* forming the first and second regions, Levenson teaches away from the claimed invention. Independent claims 1 and 15 define “performing a first patterning ... to expose a first region ... and performing additional patterning ... to expose a second region”.

To the contrary, as described in column 7, lines 63-64 of Levenson, the phase shift pattern 246 is formed in the material 242 by stamping, molding, or etching. As also described in column 7, line 65 – column 8, line 6, FIG. 25 shows a picture of construction

Appeal Brief

of a generic substrate for a generic phase shift mask blank, whereby phase shift material 254 is deposited on the flat plate in the phase shift areas 256. Such deposition systems as plasma deposition, CVD deposition, and other deposition systems are known in the art. Dissolving the resist 252 lifts off the material 254 deposited on top of the resist, and leaves material 254 in the phase shift areas 256.

Nothing within Levenson discloses exposing a first region and subsequently performing an additional patterning to expose a second region. In fact, the Office Action does not assert that such features are taught by Levenson. Instead, Levenson teaches *simultaneously* forming the first and second regions. Therefore, Appellants submit that it would not have been obvious to combine Levenson with Dao or Schroeder because Levenson teaches away from the claimed invention.

Appellants submit that Rolfson is introduced by the Office Action for the sole purpose of illustrating first and second similarly shaped and sized regions that are adjacent one another. More specifically, the Office Action asserts that “neither Dao et al. or Schroeder et al. specifically teach a method of forming a PSM having adjacent first and second similarly shaped and sized rectangular 0° and 180° phase features ... However ... a PSM having book-matched adjacent first and second similarly shaped and sized rectangular regions is well known in the art of making PSMs, as exemplified by ... Rolfson (Figure 12, col. 6 lines 28-36)” (Office Action, p. 7, para. 4 – p. 8, para. 1).

Appellants traverse the rejections because it would not have been obvious to combine Rolfson with Dao or Schroeder. More specifically, Appellants submit that because Rolfson teaches *simultaneously* forming the first and second regions, Rolfson

Appeal Brief

teaches away from the claimed invention. Independent claims 1 and 15 define “performing a first patterning ... to expose a first region ... and performing additional patterning ... to expose a second region”.

To the contrary, Rolfson teaches *simultaneously* forming the first and second regions. Specifically, Figures 1, 2, 5, and 6 of Rolfson illustrate successive processing steps of forming alternating phase shift regions 32 and 34 (See “Brief Description of the Drawings” section, col. 3, lines 4-14). Particularly, phase shift regions 32 and 34 are formed simultaneously in the processing step shown in FIG. 5.

Nothing within Rolfson discloses exposing a first region and subsequently performing an additional patterning to expose a second region. In fact, the Office Action does not assert that such features are taught by Rolfson. Instead, Rolfson teaches *simultaneously* forming the first and second regions. Therefore, Appellants submit that it would not have been obvious to combine Rolfson with Dao or Schroeder because Rolfson teaches away from the claimed invention.

The Office Action asserts that “the particular configuration shown by instant Figure 5A or instant Figure 6A” is admitted as prior art by Appellants (Office Action, p. 7, para. 4 – p. 8, para. 1). Appellants respectfully disagree. More specifically, the Office Action argues that Figures 4A-6B show the same PSM structure as Figures 1A-3B (Office Action, p. 7, para. 4 – p. 8, para. 1). However, as provided in paragraph 0018 of Appellants’ disclosure, “FIGS. 1A-3B illustrate a methodology that is utilized to create a phase shift mask. This methodology is not necessarily well known; however, the

Appeal Brief

invention is an improvement on this methodology”. Therefore, contrary to the position taken in the Office Action, Figures 5A and 6A do not disclose prior art structures.

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

b. Dependent Claims 3 and 17

It is Appellants' position that the proposed combination of Dao and Schroder does not render obvious independent claims 1 and 15 and similarly does not render obvious dependent claims 3 and 17. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

c. Dependent Claims 4 and 18

It is Appellants' position that the proposed combination of Dao and Schroder does not render obvious independent claims 1 and 15 and similarly does not render obvious dependent claims 4 and 18. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

d. Dependent Claim 5

It is Appellants' position that the proposed combination of Dao and Schroder does not render obvious independent claim 1 and similarly does not render obvious dependent claim 5. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

e. Dependent Claims 24 and 26

Appellants traverse the rejections because, among other reasons, it would not have been obvious to combine Dao with Schroeder. Appellants submit that, because Dao teaches regions comprising a rectangular ring having an intervening structure in the middle thereof, Dao teaches away from the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claims 24 and 26). As illustrated in Figures 6A and 6B of Appellants’ disclosure, a first region 114 and the second region 116 each comprise an uninterrupted rectangular surface that lacks an intervening structure. To the contrary, as illustrated in Figures 4A and 10 of Dao, the region 24 comprises a rectangular ring with an intervening structure (i.e., the block 23) in the middle thereof. Similarly, the region 27 comprises a rectangular ring with an intervening structure (i.e., the opening 26) in the middle thereof. When a reference teaches away from an invention, this tends to show that one ordinarily skilled in the art would not have made reference to the reference. Therefore, Dao would not be referred to illustrate the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claims 24 and 26).

More specifically, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the Office Action asserts teaches the second region of the claimed invention) is centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that

Appeal Brief

the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).

FIG 9

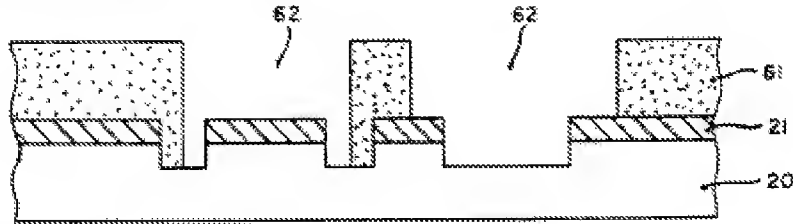
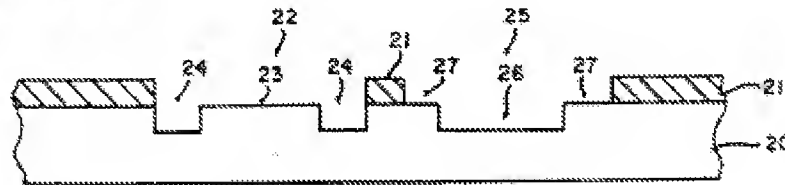


FIG 10



Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted rectangular structure. Thus, Appellants submit that the Office Action’s assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Accordingly, because the patterning layer “must be” aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely,

Appeal Brief

dependent claims 24 and 26 define that “said uninterrupted rectangular surface lacks an intervening structure”. To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the “[p]atterning layer 61 **must be** precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26” (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants’ position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” as defined in dependent claims 24 and 26.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention. Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the “first region” of the claimed invention) is not adjacent the region 27 (which the Office Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second region is adjacent said first region” as defined in independent claims 1 and 15 (from which dependent claims 24 and 26, respectively, depend upon).

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have similar size and shape as the region 458 (which the Office Action asserts teaches the

Appeal Brief

“first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second region comprises a similar shape and size as said first region” as defined in independent claims 1 and 15 (from which dependent claims 24 and 26, respectively, depend upon).

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

C. The Rejection Based on Dao, Schroeder, and Tzu

1. The Position in the Office Action

Claims 8, 10-12, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dao et al. (US 5,302,477), especially in view of Schroeder et al. (US 2003/0027057), and further in view of Tzu et al. (US 5,888,678).

While teaching other aspects of the instant claims, neither Dao et al. nor Schroeder et al. specifically teach forming additional third regions that are devoid of PS features (instant claims 8, 10-12, and 25).

Tzu et al. teach a PSM having separate PS mask patterns and non-PS binary mask patterns on the same mask substrate, as well as a method of forming this PSM (title, abstract). Formation of the PS mask patterns and binary mask patterns on the same transparent mask substrate increases throughput and decreases cost in the fabrication of integrated circuit wafers (abstract).

Appeal Brief

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention in the methods of forming PSMs having adjacent rectangular first and second PS regions that are similarly shaped and sized, wherein the first rectangular region has an uninterrupted rectangular surface that lacks an intervening structure (as taught by Dao et al., especially in view of Schroeder et al.) to form additional third binary mask pattern regions that are devoid of PS features on the same transparent mask substrate, in order to increase throughput and decrease cost in the fabrication of integrated circuit wafers (as taught by Tzu et al., instant claims 8, 10-12, and 25).

2. Appellants' Position

a. Independent Claim 8

Appellants traverse this rejection because it would not have been obvious to combine Tzu with Dao or Schroeder because Tzu teaches away from the claimed invention.

First of all, Tzu teaches against patterning an opaque layer to expose the substrate. Such features are defined in independent claim 8 using the following language: “performing a first patterning of said opaque layer to expose a first region[s] of said transparent substrate ... and performing additional patterning of said opaque layer to expose a second region[s] of said transparent substrate”.

As clearly illustrated in FIGS. 5-6 of Tzu, after removal of the opaque layer 30, the substrate 20 remains *unexposed*. As discussed in column 4, lines 16-19 of Tzu, the first pattern 37 and the second pattern 39 are etched in the layer of opaque material 30, in

Appeal Brief

this example chrome, using wet isotropic etching with an etchant such as CR-7 (HClO₄, Cl(NH₄)₂ (NO₃)₆). However, as illustrated in FIG. 6, after etching the opaque material 30, the phase shifting material 26 remains over the substrate 20; and as such, the substrate 20 remains unexposed.

Therefore, Appellants submit that Tzu teaches against the claimed feature of performing a first patterning of said opaque layer to expose a first region of said transparent substrate and performing additional patterning of said opaque layer to expose a second region of said transparent substrate (independent claim 8).

Secondly, Tzu teaches that the first and second regions of the substrate are formed *simultaneously*. Thus, Tzu teaches against the claimed feature of exposing a first region of the substrate via a first process, and subsequently exposing a second region of the substrate via an additional process (independent claim 8).

As discussed in column 4, lines 16-23 of Tzu, after the opaque layer is etched, the first pattern 37 and the second pattern 39 are etched in the layer of attenuating phase shifting material 26, in this example MoSiON, using dry anisotropic etching with an etchant such as CF₄ and O₂ (FIG. 7).

Thus, the first pattern 37 and the second pattern 39 are formed *simultaneously* via an etching process of the phase shifting material 26. Therefore, Appellants submit that Tzu teaches against the claimed feature of “performing a first patterning ... to expose a first region[s] of said transparent substrate... [and] performing additional patterning ... to expose a second region[s] of said transparent substrate” as defined by independent claim 8.

Appeal Brief

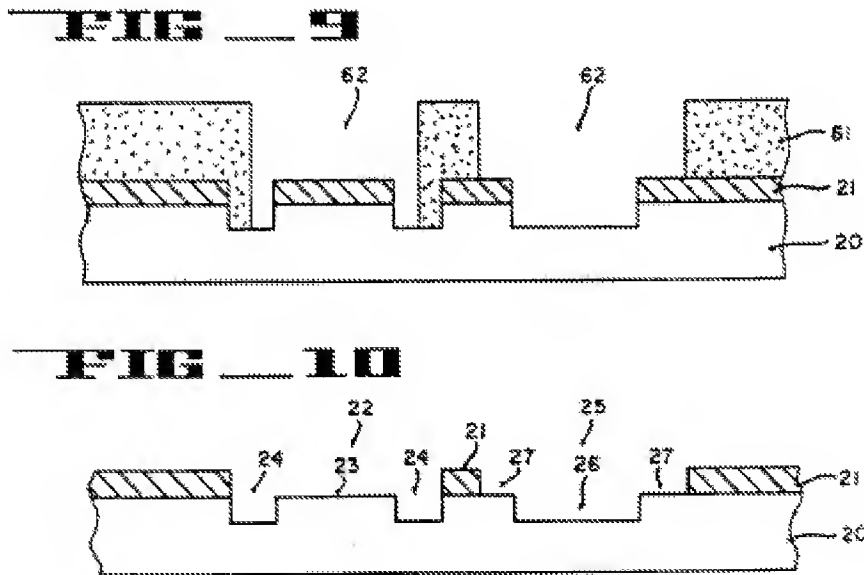
In addition, Appellants note that the second pattern 39 is not adjacent the first pattern 37 (i.e., portions of the opaque material 30 and the resist layer 32 separate the second pattern 39 from the first pattern 37). Therefore, there is a fundamental difference between the claimed invention and Tzu because Tzu teaches first and second regions that are separated by semiconductor components, whereas the claimed invention is different because the second region is adjacent the first region. As such, Tzu also teaches against the claimed feature “wherein said second regions are adjacent said first regions”, as defined by independent claim 8.

Moreover, as illustrated in FIGS. 10 and 11 of Tzu, the second pattern 39 does not have a similar shape and size as the first pattern 37. Specifically, as noted in the “Brief Description of the Drawings” section of Tzu (col. 3, lines 40-49), FIG. 10 shows a cross section view of the completed mask having a rim type attenuating phase shifting pattern (i.e., the second pattern 39) for *small* contact holes in one region of the mask and a binary mask pattern (i.e., the first pattern 37) for *large* contact holes in another region of the mask. Additionally, FIG. 11 of Tzu shows a top view of a mask having a rim type attenuating phase shifting pattern (i.e., the second pattern 39) for *small* contact holes and a binary mask pattern (i.e., the first pattern 37) for *large* contact holes. Therefore, there is a fundamental difference between the claimed invention and Tzu because Tzu teaches different shaped and sized first and second regions, whereas the claimed invention is different because the second region comprises a similar shape and size as the first region.

Appeal Brief

Therefore, Tzu also teaches against the claimed feature wherein “said second regions comprise similar shapes and sizes as said first regions, wherein said second regions are adjacent said first regions”, as defined by independent claim 8.

In addition, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the Office Action asserts teaches the second region of the claimed invention) is centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).



Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted

Appeal Brief

rectangular structure. Thus, Appellants submit that the Office Action's assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Accordingly, because the patterning layer "must be" aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely, independent claim 8 defines that "said first regions comprise uninterrupted rectangular surfaces". To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the "[p]atterning layer 61 must be precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26" (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants' position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features "wherein said first regions comprise uninterrupted rectangular surfaces ... and ... said second regions comprise similar shapes and sizes as said first regions" as defined in independent claim 8.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention. Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the "first region" of the claimed invention) is not adjacent the region 27 (which the Office

Appeal Brief

Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second regions are adjacent said first regions” as defined in independent claim 8.

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have similar size and shape as the region 458 (which the Office Action asserts teaches the “first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second regions comprise similar shapes and sizes as said first regions” as defined in independent claim 8.

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

b. Dependent Claim 10

It is Appellants' position that the proposed combination of Dao, Schroeder, and Tzu does not render obvious independent claim 1 and similarly does not render obvious dependent claim 10. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

c. Dependent Claim 11

It is Appellants' position that the proposed combination of Dao, Schroeder, and Tzu does not render obvious independent claim 1 and similarly does not render obvious dependent claim 11. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

d. Dependent Claim 12

It is Appellants' position that the proposed combination of Dao, Schroeder, and Tzu does not render obvious independent claim 1 and similarly does not render obvious dependent claim 12. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

e. Dependent Claim 25

Appellants traverse the rejections because, among other reasons, it would not have been obvious to combine Dao with Schroeder. Appellants submit that, because Dao teaches regions comprising a rectangular ring having an intervening structure in the middle thereof, Dao teaches away from the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claim 25). As illustrated in Figures 6A and 6B of Appellants’ disclosure, a first region 114 and the second region 116 each comprise an uninterrupted rectangular surface that lacks an intervening structure. To the contrary, as illustrated in Figures 4A and 10 of Dao, the region 24 comprises a rectangular ring with an intervening structure (i.e., the block 23) in the

Appeal Brief

middle thereof. Similarly, the region 27 comprises a rectangular ring with an intervening structure (i.e., the opening 26) in the middle thereof. When a reference teaches away from an invention, this tends to show that one ordinarily skilled in the art would not have made reference to the reference. Therefore, Dao would not be referred to illustrate the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claim 25).

More specifically, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the Office Action asserts teaches the second region of the claimed invention) is centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).

FIG 9

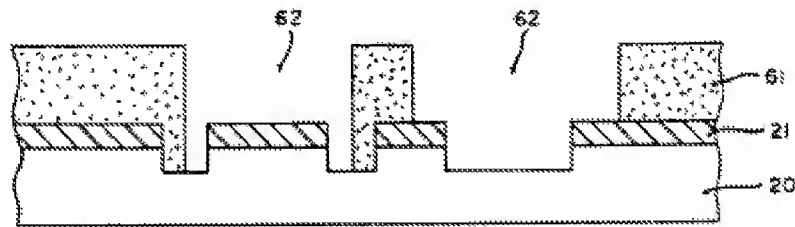
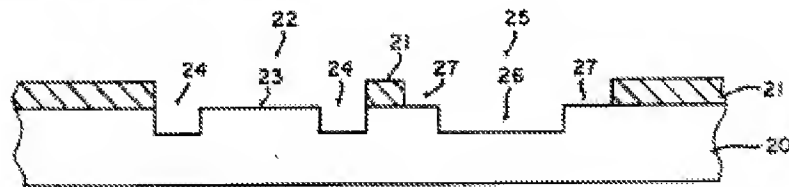


FIG 10



Appeal Brief

Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted rectangular structure. Thus, Appellants submit that the Office Action's assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Accordingly, because the patterning layer "must be" aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely, dependent claim 25 defines that "said uninterrupted rectangular surface lacks an intervening structure". To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the "[p]atterning layer 61 must be precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26" (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants' position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features "wherein said uninterrupted rectangular surface lacks an intervening structure" as defined in dependent claim 25.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention.

Appeal Brief

Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the “first region” of the claimed invention) is not adjacent the region 27 (which the Office Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second regions are adjacent said first regions” as defined in independent claim 8 (from which dependent claim 25 depends upon).

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have similar size and shape as the region 458 (which the Office Action asserts teaches the “first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second regions comprise similar shapes and sizes as said first regions” as defined in independent claim 8 (from which dependent claim 25 depends upon).

D. The Rejection Based on Dao, Schroeder, Tzu, and Levenson, Rolfson, or AAPA

1. The Position in the Office Action

Claims 8, 10-12, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dao Ct al. (US 5,302,477), especially in view of Schroeder et al. (US 2003/0027057), further in view of Tzu et al. (US 5,888,678), and further in view of either

Appeal Brief

Levenson (US 6,251,549), Rolfson (US 6,395,432), or Appellant's admitted prior art (AAPA).

While teaching other aspects of the instant claims, none of Dao et al., Schroeder et al., nor Tzu et al. specifically teach a method of forming a PSM having adjacent first and second similarly shaped and sized rectangular 0° non-PS and 180° PS features or regions, wherein the first rectangular region has an uninterrupted rectangular surface that lacks an intervening structure, in the particular configuration shown by instant Figure 5A or instant Figure 6A (as specific examples of instant claims 8, 10-12, and 25).

However, the particular configuration shown by instant Figure 5A or instant Figure 6A (for a PSM having book-matched adjacent first and second similarly shaped and sized rectangular 0° non-PS and 180° PS features or regions, wherein the first rectangular region has an uninterrupted rectangular surface that lacks an intervening structure) is either the same or very similar to the PSM configurations exemplified by either Levenson, Rolfson, or AAPA (as discussed above). So, it would have been obvious to one of ordinary skill in the art at the time of the invention in the methods of forming PSMs having adjacent first and second PS regions, wherein the first region has an uninterrupted rectangular surface that lacks an intervening structure, and separate additional third binary mask pattern regions that are devoid of PS features on the same transparent mask substrate (as taught by Dao et al., especially in view of Schroeder et al., in combination with Tzu et al.) to form the adjacent first and second PS regions in a book- matched configuration of similarly shaped and sized rectangular 0° non-PS and 180° PS features or regions (as taught by either Levenson, Rolfson, or AAPA as

exemplified by instant prior art Figures 1A to 3B), which has the same PSM structure exemplified by instant Figures 5A or 6A, in order to achieve a corresponding desired imaged pattern through such a PSM (instant claims 8, 10-12, and 25).

2. Appellants' Position

a. Independent Claim 8

Appellants traverse this rejection because it would not have been obvious to combine Tzu with Dao or Schroeder because Tzu teaches away from the claimed invention.

First of all, Tzu teaches against patterning an opaque layer to expose the substrate. Such features are defined in independent claim 8 using the following language: “performing a first patterning of said opaque layer to expose a first region[s] of said transparent substrate ... and performing additional patterning of said opaque layer to expose a second region[s] of said transparent substrate”.

As clearly illustrated in FIGS. 5-6 of Tzu, after removal of the opaque layer 30, the substrate 20 remains *unexposed*. As discussed in column 4, lines 16-19 of Tzu, the first pattern 37 and the second pattern 39 are etched in the layer of opaque material 30, in this example chrome, using wet isotropic etching with an etchant such as CR-7 (HClO₄, Cl(NH₄)₂ (NO₃)₂). However, as illustrated in FIG. 6, after etching the opaque material 30, the phase shifting material 26 remains over the substrate 20; and as such, the substrate 20 remains unexposed.

Appeal Brief

Therefore, Appellants submit that Tzu teaches against the claimed feature of performing a first patterning of said opaque layer to expose a first region of said transparent substrate and performing additional patterning of said opaque layer to expose a second region of said transparent substrate (independent claim 8).

Secondly, Tzu teaches that the first and second regions of the substrate are formed *simultaneously*. Thus, Tzu teaches against the claimed feature of exposing a first region of the substrate via a first process, and subsequently exposing a second region of the substrate via an additional process (independent claim 8).

As discussed in column 4, lines 16-23 of Tzu, after the opaque layer is etched, the first pattern 37 and the second pattern 39 are etched in the layer of attenuating phase shifting material 26, in this example MoSiON, using dry anisotropic etching with an etchant such as CF₄ and O₂ (FIG. 7).

Thus, the first pattern 37 and the second pattern 39 are formed *simultaneously* via an etching process of the phase shifting material 26. Therefore, Appellants submit that Tzu teaches against the claimed feature of “performing a first patterning ... to expose a first region[s] of said transparent substrate... [and] performing additional patterning ... to expose a second region[s] of said transparent substrate” as defined by independent claim 8.

In addition, Appellants note that the second pattern 39 is not adjacent the first pattern 37 (i.e., portions of the opaque material 30 and the resist layer 32 separate the second pattern 39 from the first pattern 37). Therefore, there is a fundamental difference between the claimed invention and Tzu because Tzu teaches first and second regions that

Appeal Brief

are separated by semiconductor components, whereas the claimed invention is different because the second region is adjacent the first region. As such, Tzu also teaches against the claimed feature “wherein said second regions are adjacent said first regions”, as defined by independent claim 8.

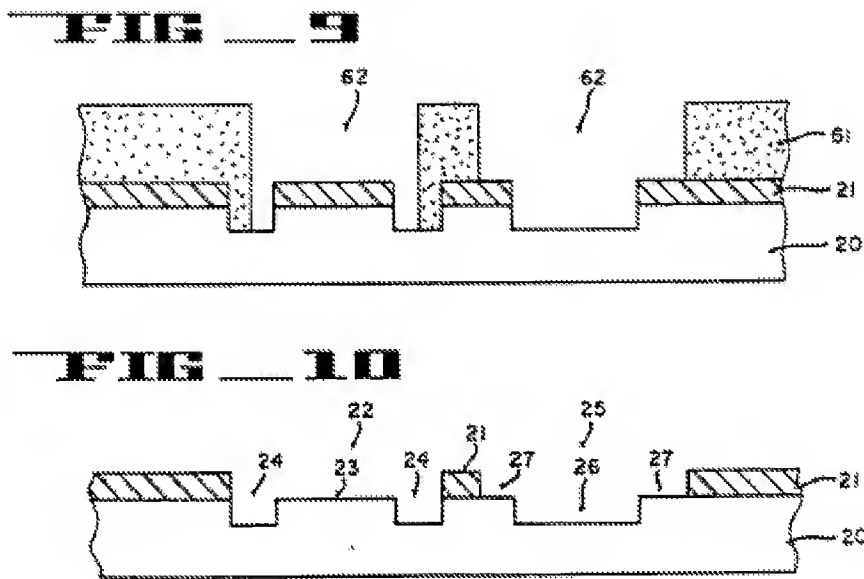
Moreover, as illustrated in FIGS. 10 and 11 of Tzu, the second pattern 39 does not have a similar shape and size as the first pattern 37. Specifically, as noted in the “Brief Description of the Drawings” section of Tzu (col. 3, lines 40-49), FIG. 10 shows a cross section view of the completed mask having a rim type attenuating phase shifting pattern (i.e., the second pattern 39) for *small* contact holes in one region of the mask and a binary mask pattern (i.e., the first pattern 37) for *large* contact holes in another region of the mask. Additionally, FIG. 11 of Tzu shows a top view of a mask having a rim type attenuating phase shifting pattern (i.e., the second pattern 39) for *small* contact holes and a binary mask pattern (i.e., the first pattern 37) for *large* contact holes. Therefore, there is a fundamental difference between the claimed invention and Tzu because Tzu teaches different shaped and sized first and second regions, whereas the claimed invention is different because the second region comprises a similar shape and size as the first region.

Therefore, Tzu also teaches against the claimed feature wherein “said second regions comprise similar shapes and sizes as said first regions, wherein said second regions are adjacent said first regions”, as defined by independent claim 8.

In addition, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the

Appeal Brief

Office Action asserts teaches the second region of the claimed invention) is centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).



Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted rectangular structure. Thus, Appellants submit that the Office Action’s assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Appeal Brief

Accordingly, because the patterning layer “must be” aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely, independent claim 8 defines that “said first regions comprise uninterrupted rectangular surfaces”. To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the “[p]atterning layer 61 must be precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26” (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants’ position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features “wherein said first regions comprise uninterrupted rectangular surfaces ... and ... said second regions comprise similar shapes and sizes as said first regions” as defined in independent claim 8.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention. Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the “first region” of the claimed invention) is not adjacent the region 27 (which the Office Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second regions are adjacent said first regions” as defined in independent claim 8.

Appeal Brief

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have similar size and shape as the region 458 (which the Office Action asserts teaches the “first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second regions comprise similar shapes and sizes as said first regions” as defined in independent claim 8.

In addition, Appellants submit that Levenson is introduced by the Office Action for the sole purpose of illustrating first and second similarly shaped and sized regions that are adjacent one another. More specifically, the Office Action asserts that “neither Dao et al. or Schroeder et al. specifically teach a method of forming a PSM having adjacent first and second similarly shaped and sized rectangular 0° and 180° phase features ... However ... a PSM having book-matched adjacent first and second similarly shaped and sized rectangular regions is well known in the art of making PSMs, as exemplified by ... Levenson (Figures 9-11, col. 6 lines 53-61)” (Office Action, p. 7, para. 4 – p. 8, para. 1).

Appellants traverse the rejections because it would not have been obvious to combine Levenson with Dao or Schroeder. More specifically, Appellants submit that because Levenson teaches *simultaneously* forming the first and second regions, Levenson teaches away from the claimed invention. Independent claim 8 defines “performing a first patterning ... to expose first regions ... and performing additional patterning ... to expose second regions and third regions”.

Appeal Brief

To the contrary, as described in column 7, lines 63-64 of Levenson, the phase shift pattern 246 is formed in the material 242 by stamping, molding, or etching. As also described in column 7, line 65 – column 8, line 6, FIG. 25 shows a picture of construction of a generic substrate for a generic phase shift mask blank, whereby phase shift material 254 is deposited on the flat plate in the phase shift areas 256. Such deposition systems as plasma deposition, CVD deposition, and other deposition systems are known in the art. Dissolving the resist 252 lifts off the material 254 deposited on top of the resist, and leaves material 254 in the phase shift areas 256.

Nothing within Levenson discloses exposing a first region and subsequently performing an additional patterning to expose a second region. In fact, the Office Action does not assert that such features are taught by Levenson. Instead, Levenson teaches *simultaneously* forming the first and second regions. Therefore, Appellants submit that it would not have been obvious to combine Levenson with Dao or Schroeder because Levenson teaches away from the claimed invention.

Appellants submit that Rolfson is introduced by the Office Action for the sole purpose of illustrating first and second similarly shaped and sized regions that are adjacent one another. More specifically, the Office Action asserts that “neither Dao et al. or Schroeder et al. specifically teach a method of forming a PSM having adjacent first and second similarly shaped and sized rectangular 0° and 180° phase features ... However ... a PSM having book-matched adjacent first and second similarly shaped and sized rectangular regions is well known in the art of making PSMs, as exemplified by ... Rolfson (Figure 12, col. 6 lines 28-36)” (Office Action, p. 7, para. 4 – p. 8, para. 1).

Appeal Brief

Appellants traverse the rejections because it would not have been obvious to combine Rolfson with Dao or Schroeder. More specifically, Appellants submit that because Rolfson teaches *simultaneously* forming the first and second regions, Rolfson teaches away from the claimed invention. Independent claim 8 defines “performing a first patterning ... to expose first regions ... and performing additional patterning ... to expose second regions and third regions”.

To the contrary, Rolfson teaches *simultaneously* forming the first and second regions. Specifically, Figures 1, 2, 5, and 6 of Rolfson illustrate successive processing steps of forming alternating phase shift regions 32 and 34 (See “Brief Description of the Drawings” section, col. 3, lines 4-14). Particularly, phase shift regions 32 and 34 are formed simultaneously in the processing step shown in FIG. 5.

Nothing within Rolfson discloses exposing a first region and subsequently performing an additional patterning to expose a second region. In fact, the Office Action does not assert that such features are taught by Rolfson. Instead, Rolfson teaches *simultaneously* forming the first and second regions. Therefore, Appellants submit that it would not have been obvious to combine Rolfson with Dao or Schroeder because Rolfson teaches away from the claimed invention.

The Office Action asserts that “the particular configuration shown by instant Figure 5A or instant Figure 6A” is admitted as prior art by Appellants (Office Action, p. 7, para. 4 – p. 8, para. 1). Appellants respectfully disagree. More specifically, the Office Action argues that Figures 4A-6B show the same PSM structure as Figures 1A-3B (Office Action, p. 7, para. 4 – p. 8, para. 1). However, as provided in paragraph 0018 of

Appeal Brief

Appellants' disclosure, "FIGS. 1A-3B illustrate a methodology that is utilized to create a phase shift mask. This methodology is not necessarily well known; however, the invention is an improvement on this methodology". Therefore, contrary to the position taken in the Office Action, Figures 5A and 6A do not disclose prior art structures.

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

b. Dependent Claim 10

It is Appellants' position that the proposed combination of Dao, Schroeder, and Tzu does not render obvious independent claim 1 and similarly does not render obvious dependent claim 10. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

c. Dependent Claim 11

It is Appellants' position that the proposed combination of Dao, Schroeder, and Tzu does not render obvious independent claim 1 and similarly does not render obvious dependent claim 11. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

d. Dependent Claim 12

It is Appellants' position that the proposed combination of Dao, Schroeder, and Tzu does not render obvious independent claim 1 and similarly does not render obvious

Appeal Brief

dependent claim 12. In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

e. Dependent Claim 25

Appellants traverse the rejections because, among other reasons, it would not have been obvious to combine Dao with Schroeder. Appellants submit that, because Dao teaches regions comprising a rectangular ring having an intervening structure in the middle thereof, Dao teaches away from the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claim 25). As illustrated in Figures 6A and 6B of Appellants’ disclosure, a first region 114 and the second region 116 each comprise an uninterrupted rectangular surface that lacks an intervening structure. To the contrary, as illustrated in Figures 4A and 10 of Dao, the region 24 comprises a rectangular ring with an intervening structure (i.e., the block 23) in the middle thereof. Similarly, the region 27 comprises a rectangular ring with an intervening structure (i.e., the opening 26) in the middle thereof. When a reference teaches away from an invention, this tends to show that one ordinarily skilled in the art would not have made reference to the reference. Therefore, Dao would not be referred to illustrate the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” (dependent claim 25).

More specifically, Appellants submit that Dao teaches away from the claimed invention because Dao teaches that a patterning layer must be aligned such that a rim (which the Office Action asserts teaches the second region of the claimed invention) is

Appeal Brief

centered about an intervening structure. Referring to Figures 9 and 10, Dao teaches that the “[p]atterning layer 61 *must be* precisely aligned to ensure ... that [the] phase-shifting rim 27 is centered about the opening 26” (Dao, col. 9, lines 3-5 (emphasis added)).

FIG 9

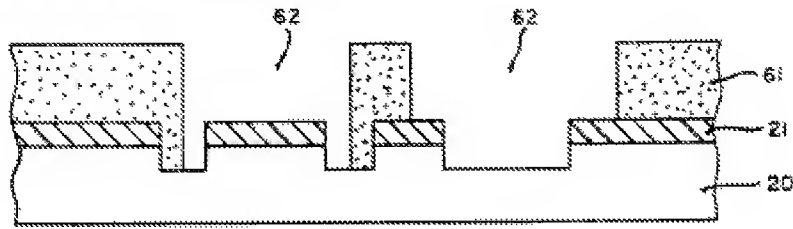
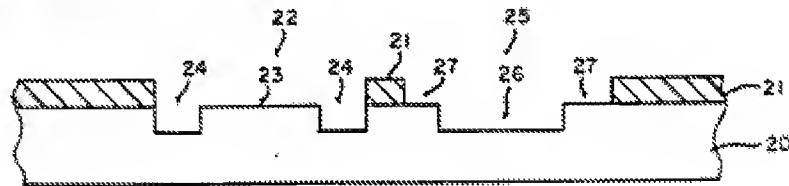


FIG 10



Appellants submit that the opening 26 is the *intervening structure* within the phase-shifting rim 27 that prevents the phase-shifting rim 27 from being an uninterrupted rectangular structure. Thus, Appellants submit that the Office Action’s assertion that the phase-shifting rim 27 teaches an uninterrupted rectangular structure is incorrect. Further, Appellants submit that the positioning of the intervening opening 26 (within the phase-shifting rim 27) is a direct and necessary result of the *required* alignment of the patterning layer 61.

Accordingly, because the patterning layer “must be” aligned in such a way, the resulting opening 26 must be formed as an intervening structure that teaches away from

Appeal Brief

the phase-shifting rim 27 being an uninterrupted rectangular structure. Conversely, dependent claim 25 defines that “said uninterrupted rectangular surface lacks an intervening structure”. To attempt to combine the uninterrupted rectangular surface of Schroeder with the structure of Dao would be to ignore and disregard the direct and explicit teachings of Dao (i.e., that the “[p]atterning layer 61 must be precisely aligned to ensure, for example, that phase-shifting rim 27 is centered about opening 26” (Dao, col. 9, lines 3-5 (emphasis added))). Therefore, it is Appellants’ position that it would not have been obvious to combine the structure of Schroeder with the teachings of Dao; and as such, the prior art of record fails to teach or suggest the claimed features “wherein said uninterrupted rectangular surface lacks an intervening structure” as defined in dependent claim 25.

Furthermore, Appellants submit that even if the structure of Dao were combined with the teachings of Schroeder, the combination would not teach the claimed invention. Referring to FIG. 10 of Dao, the region 24 (which the Office Action asserts teaches the “first region” of the claimed invention) is not adjacent the region 27 (which the Office Action asserts teaches the “second region” of the claimed invention). Specifically, the chrome element 21 and a portion of the quartz plate 20 block the region 24 from the region 27. Thus, Dao also teaches away from the claimed features “wherein said second regions are adjacent said first regions” as defined in independent claim 8 (from which dependent claim 25 depends upon).

Moreover, referring to FIGS. 6a and 6b of Schroeder, the region 460 (which the Office Action asserts teaches the “second region” of the claimed invention) does not have

Appeal Brief

similar size and shape as the region 458 (which the Office Action asserts teaches the “first region” of the claimed invention). Instead, the region 460 is nearly half the size of the region 458. Therefore, Appellants submit that Schroeder teaches away from the claimed features wherein “said second regions comprise similar shapes and sizes as said first regions” as defined in independent claim 8 (from which dependent claim 25 depends upon).

E. The Rejection Based on Dao, Schroeder, Sandstrom, and Levenson, Rolfson, or AAPA

1. The Position in the Office Action

Claims 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dao et al. (US 5,302,477), especially in view of Schroeder et al. (US 2003/0027057), further in view of either Levenson (US 6,251,549), Rolfson (US 6,395,432), or Appellant’s admitted prior art (AAPA), and further in view of Sandstrom (US 2002/0125443).

While teaching other aspects of the instant claims, neither Dao et al., Schroeder et al., Levenson, Rolfson, nor AAPA specifically teach a method of forming a PSM in which the etching of a first PS region and the subsequent additional patterning of an adjacent second non- PS region both attack the substrate of the PSM (instant claims 21 and 23).

Sandstrom teaches methods of making PSMs (title, abstract). Figure 3D shows a latter process step for making a PSM having a top non-transmitting/opaque region 302

Appeal Brief

(of one or more layers, on the left), which is directly adjacent to a first PS window/region 325 (etched into the substrate 100) that is deeper than another directly adjacent subsequently additionally patterned (etched) second non-PS window/region 327 (on the right) [0075]. The patterned non_transmissive/opaque material is typically Cr [0065]. Thus, the first etching step to pattern the PS region 325 and the subsequent additional patterning by etching to form the second region 327 both attack the substrate of the PSM (instant claims 21 and 23). Further etching during the additional patterning of the PSM substrate is useful for improving uniformity [0074].

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of forming a PSM having a first etched PS region and an adjacent second additionally patterned transmissive region enlarging a patterned opening in an opaque layer, such that the adjacent first and second regions are in a book-matched configuration of similarly shaped and sized rectangular PS and non-PS regions, wherein the first rectangular region has an uninterrupted rectangular surface that lacks an intervening structure (as taught by Dao et al., especially in view of Schroeder et al., in combination with either Levenson, Rolfson, or AAPA, which are discussed above) to have further attacked or etched the PSM substrate during the additional patterning step, because this further etching during additional patterning of the PSM substrate is useful for improving uniformity (as taught by Sandstrom, instant claims 21 and 23).

2. Appellants' Position

a. Dependent Claims 21 and 23

Appellants submit that Sandstrom is introduced by the Office Action for the sole purpose of illustrating first and second patterning processes that both attack the substrate of the PSM. More specifically, the Office Action asserts that “neither Dao et al., Schroeder et al., Levenson, Rolfson, nor Appellant’s admitted prior art specifically teach a method of forming a PSM in which the etching of a first PS region and the subsequent additional patterning of an adjacent second non-PS region both attack the substrate of the PSM ... Sandstrom teaches ... first etching step to pattern the PS region 327 and the subsequent additional patterning by etching to form the second region 325 both attack the substrate of the PSM (Office Action, p. 10, para. 3 – p. 11, para. 1).

Appellants traverse the rejections because it would not have been obvious to combine Sandstrom with Dao or Schroeder and Levenson, Rolfson, or AAPA. More specifically, Appellants submit that because Sandstrom teaches exposing the region 327 (which the Office Action asserts teaches the second region of the claimed invention) by not patterning the layer 302, Sandstrom teaches away from the claimed invention. To the contrary, as defined in independent claims 1 and 15 (from which dependent claims 21 and 23 depend upon), the claimed invention includes “performing additional patterning of said opaque ... layer to expose a second region”.

Nothing within Sandstrom discloses exposing the region 327 (which the Office Action asserts teaches the second region of the claimed invention) by patterning an opaque layer. Instead, Sandstrom teaches exposing the region 327 by etching the

Appeal Brief

substrate (See Sandstrom, FIGS. 3A – 3D and accompanying text). The layer 302, which overlays the substrate, is not affected by the etching processes (shown in FIGS. 3B and 3C). Therefore, Appellants submit that it would not have been obvious to combine Sandstrom with Dao or Schroeder and Levenson, Rolfson, or AAPA because Sandstrom teaches away from the claimed feature of “performing additional patterning of said opaque ... layer to expose a second region”.

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

F. The Rejection Based on Dao, Schroeder, Tzu, Sandstrom, and Levenson, Rolfson, or AAPA

1. The Position in the Office Action

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Daó et al. (US 5,302,477), especially in view of Schroeder et al. (US 2003/0027057), further in view of Tzu et al. (US 5,888,678), further in view of either Levenson (US 6,251,549), Rolfson (US 6,395,432), or Appellant’s admitted prior art (AAPA), and further in view of Sandstrom (US 2002/0 125443).

The teachings of Sandstrom are discussed above.

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of forming a PSM having first etched PS regions and adjacent second additionally patterned transmissive regions enlarging patterned openings in an opaque layer, such that the adjacent first and second regions are in book-matched

Appeal Brief

configurations of similarly shaped and sized rectangular PS and non-PS regions, wherein the first rectangular regions each have an uninterrupted rectangular surface that lacks an intervening structure (as taught by Dao et al., especially in view of Schroeder et al., in combination with Tzu et al. and either Levenson, Rolfson, or AAPA, which are discussed above) to have further attacked or etched the PSM substrate during the additional patterning step, because this further etching during additional patterning of the PSM substrate is useful for improving uniformity (as taught by Sandstrom, instant claim 22).

Response to Argument

Appellant's arguments with respect to claims 1, 3-5, 8, 10-12, 15, 17-18, and 21-26 have been considered, but they are either unpersuasive or moot in view of the revised and new ground(s) of rejection set forth above, as necessitated by the current amendment.

In response to Appellant's arguments on pages 17-25 that Levenson, Rolfson, and Tzu et al. each teach(es) simultaneously forming the first and second regions of a PSM, which Appellant's contend teach away from the methods of separately forming the first and second regions of the PSM (as taught by Dao et al., especially in view of Schroeder et al., discussed above), the test for obviousness is not whether the features (or methods) of a secondary reference may be bodily incorporated into the structure or method of one or more primary references; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Appeal Brief

As set forth above, it would have been obvious in the method of making a PSM taught by Daó et al. that includes separately forming the first and second rectangular regions in the opaque layer, forming similarly sized and shaped first and second rectangular openings in the opaque layer, to make the first rectangular region or opening as an uninterrupted rectangular surface that lacks an intervening structure, because this is a simple alternative PSM configuration that is reasonably encompassed within “any” PSM pattern having a PS element or region in close proximity to another (e.g., non-PS, etc.) region (as contemplated by Dao et al.). Also, this would have been especially obvious in view of the known PSM configuration including an uninterrupted rectangular surface first region lacking an intervening structure and an adjacent rectangular second region having a similar shape (as taught by Schroeder et al.), because one of ordinary skill in the art would have a reasonable expectation of success in making this known PSM configuration (as taught by Schroeder et al.) by the method contemplated by Dao et al. to be suitable for making “any” PSM pattern having a PS element or region in close proximity to another (e.g., non-PS, etc.) region.

In response to Appellant’s arguments on pages 17-25 that Levenson, Rolfson, and Tzu et al. each teach(es) away from the methods of separately forming the first and second regions of the PSM (as taught by Dao et al., especially in view of Schroeder et al., discussed above), the fact that Appellant may have recognized another advantage which would flow naturally from following the suggestion of the. prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Exparte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Appeal Brief

In response to Appellant's arguments on pages 17-25 that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the motivation for combining the secondary references with Dao et al., especially in view of Schroeder et al., is found at least in Dao et al. (as discussed above).

On page 19 in the last paragraph, Appellant asserts that instant Figures 5A and 6A do not disclose prior art structures. However, instant Figure 3A is clearly labeled to be prior art and a comparison of instant prior art Figure 3A to those of instant Figures 5A and 6A clearly shows that all three of these drawings have the same PSM configuration of book-matched adjacent first and second similarly shaped and sized rectangular 0° non-PS and 180° PS features or regions, wherein the first rectangular region has an uninterrupted rectangular surface that lacks an intervening structure. Furthermore, Appellant admits at [0020] lines 1-5 that instant prior art Figures 1A to 38 have the same PSM structure (or configuration) as shown by instant Figures 4A to 6B (as previously pointed out). This also provides adequate response to similar assertions on pages 23.

In response to Appellant's arguments on pages 20-22 against the Tzu et al. reference alone and on pages 23-24 against the Sandstrom reference alone, one cannot show nonobviousness by attacking a reference individually where the rejections relying

Appeal Brief

upon each of these references are based on combinations of each reference with one or more other references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The reasons for combining each of Tzu et al. and Sandstrom with other reference(s) have been previously stated and are again set forth above. Tzu et al. teach that forming additional third binary mask pattern regions that are devoid of PS features on the same transparent mask substrate having PS features increases throughput and decreases cost in the fabrication of integrated circuit wafers. Sandstrom teaches plural etching steps that attack the substrate to make a PSM and that further etching during the additional patterning of the PSM substrate is useful for improving uniformity. Neither Tzu et al. nor Sandstrom is relied upon to teach the additional aspects that are taught by other applicable reference(s).

2. Appellants' Position

Appellants submit that Sandstrom is introduced by the Office Action for the sole purpose of illustrating first and second patterning processes that both attack the substrate of the PSM. More specifically, the Office Action asserts that “neither Dao et al., Schroeder et al., Levenson, Rolfson, nor Appellant’s admitted prior art specifically teach a method of forming a PSM in which the etching of a first PS region and the subsequent additional patterning of an adjacent second non-PS region both attack the substrate of the PSM ... Sandstrom teaches ... first etching step to pattern the PS region 327 and the subsequent additional patterning by etching to form the second region 325 both attack the substrate of the PSM (Office Action, p. 10, para. 3 – p. 11, para. 1).

Appeal Brief

Appellants traverse the rejections because it would not have been obvious to combine Sandstrom with Dao, Schroeder, Tzu, and Levenson, Rolfson, or AAPA. More specifically, Appellants submit that because Sandstrom teaches exposing the region 327 (which the Office Action asserts teaches the second region of the claimed invention) by not patterning the layer 302, Sandstrom teaches away from the claimed invention. To the contrary, as defined in independent claim 8 (from which dependent claim 22 depends upon), the claimed invention includes “performing additional patterning of said opaque ... layer to expose second regions”.

Nothing within Sandstrom discloses exposing the region 327 (which the Office Action asserts teaches the second region of the claimed invention) by patterning an opaque layer. Instead, Sandstrom teaches exposing the region 327 by etching the substrate (See Sandstrom, FIGS. 3A – 3D and accompanying text). The layer 302, which overlays the substrate, is not affected by the etching processes (shown in FIGS. 3B and 3C). Therefore, Appellants submit that it would not have been obvious to combine Sandstrom with Dao, Schroeder, Tzu, and Levenson, Rolfson, or AAPA because Sandstrom teaches away from the claimed feature of “performing additional patterning of said opaque ... layer to expose a second region”.

In view the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

Appeal Brief

G. CONCLUSION

In view the forgoing, the Board is respectfully requested to reconsider and withdraw the rejections of claims 1, 3-5, 8, 10-12, 15, 17-18, and 21-26.

Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

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IX. CLAIMS APPENDIX

1. (Previously Presented) A method of forming a phase shift mask, said method comprising:

forming an opaque layer on a transparent substrate;

performing a first patterning of said opaque layer to expose a first region of said transparent substrate, wherein said first region comprises an uninterrupted rectangular surface;

etching said first region of said transparent substrate to create a phase shift region within said transparent substrate; and

performing additional patterning of said opaque layer to expose a second region of said transparent substrate, such that said second region comprises a similar shape and size as said first region, wherein said second region is adjacent said first region, and wherein said additional patterning process enlarges an opening formed in said first patterning process.

2. (Canceled).

3. (Original) The method in claim 1, wherein said first region and said second region comprise a continuous area of said transparent substrate.

4. (Original) The method in claim 1, wherein said opaque layer comprises a chrome mask.

Appeal Brief

5. (Original) The method in claim 1, wherein said transparent substrate comprises a quartz substrate.

6-7. (Canceled).

8. (Previously Presented) A method of forming a phase shift mask, said method comprising:

forming an opaque layer on a transparent substrate;
performing a first patterning of said opaque layer to expose first regions of said transparent substrate, wherein said first regions comprise uninterrupted rectangular surfaces;

etching said first regions of said transparent substrate to create phase shift regions within said transparent substrate; and

performing additional patterning of said opaque layer to expose second regions and third regions of said transparent substrate, such that said second regions comprise similar shapes and sizes as said first regions, wherein said second regions are adjacent said first regions and said third regions are separated from said first regions, such that said third regions are devoid of phase shift features, and wherein said additional patterning process enlarges openings formed in said first patterning process.

9. (Canceled).

Appeal Brief

10. (Original) The method in claim 8, wherein each pair of said first regions and said second regions comprises a continuous area of said transparent substrate.

11. (Original) The method in claim 8, wherein said opaque layer comprises a chrome mask.

12. (Original) The method in claim 8, wherein said transparent substrate comprises a quartz substrate.

13-14. (Canceled).

15. (Previously Presented) A method of forming a phase shift mask, said method comprising:

forming an opaque chrome layer on a transparent quartz substrate;

performing a first patterning of said opaque chrome layer to expose a first region of said transparent quartz substrate, wherein said first region comprises an uninterrupted rectangular surface;

etching said first region of said transparent quartz substrate to create a phase shift region within said transparent quartz substrate; and

performing additional patterning of said opaque chrome layer to expose a second region of said transparent quartz substrate, such that said second region comprises a similar shape and size as said first region, wherein said second region is adjacent said

Appeal Brief

first region, and wherein said additional patterning process enlarges an opening formed in said first patterning process.

16. (Canceled).

17. (Original) The method in claim 15, wherein said first region and said second region comprise a continuous area of said transparent quartz substrate.

18. (Original) The method in claim 15, wherein said opaque chrome layer comprises a chrome mask.

19-20. (Canceled).

21. (Previously Presented) The method in claim 1, wherein said etching and said additional patterning both attack said substrate.

22. (Previously Presented) The method in claim 8, wherein said etching and said additional patterning both attack said substrate.

23. (Previously Presented) The method in claim 15, wherein said etching and said additional patterning both attack said substrate.

Appeal Brief

24. (Previously Presented) The method in claim 1, wherein said uninterrupted rectangular surface lacks an intervening structure.

25. (Previously Presented) The method in claim 8, wherein said uninterrupted rectangular surfaces lack intervening structures.

26. (Previously Presented) The method in claim 15, wherein said uninterrupted rectangular surface lacks an intervening structure.

X. EVIDENCE APPENDIX

There is no other evidence known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

XI. RELATED PROCEEDINGS APPENDIX

There is no other related proceedings known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.